

CLAIMS

What is claimed is:

1. A fiber-optic transceiver for use in optical communications where the fiber-optic transceiver may receive optical signals of varying powers, the fiber-optic transceiver comprising:

an avalanche photodiode comprising:

a gain layer;

an absorption layer; and

a field control layer disposed between the gain layer and the absorption layer, the field control layer having a doping thickness product that determines a dynamic range and is a product of a density of a dopant and a thickness of the field control layer, wherein the doping thickness product ;

a power supply that supplies a range of bias voltages to the avalanche photodiode, wherein the doping thickness product of the field control layer causes the avalanche photodiode to operate in an avalanche region when biased by a bias voltage in the range of bias voltages; and

a feedback mechanism that controls the bias voltage in response to the current through the avalanche photodiode.

2. The fiber-optic transceiver of claim 1, the feedback mechanism comprising a resistor in series with the avalanche photodiode.

3. The fiber-optic transceiver of claim 1, the feedback mechanism comprising a current monitor that monitors the current through the photodiode, the power supply voltage being adjusted based on the value of the current through the photodiode.

4. The fiber-optic transceiver of claim 3, the current monitor comprising a current mirror.

5. The fiber-optic transceiver of claim 3, the current monitor comprising a sensing resistor.

6. The fiber-optic transceiver of claim 3, the current monitor comprising a current transformer.

7. The fiber optic transceiver of claim 1 wherein lowering the doping thickness product lowers a punch-through voltage and raises a breakdown voltage to increase the dynamic range.

8. A method for controlling the gain of optical signals received in fiber-optic communications, the method comprising:

receiving an optical signal;

directing the optical signal into an avalanche photodiode to induce a current to flow in the avalanche photodiode, the avalanche photodiode having a field control layer with a doping thickness product that determines a width of an avalanche region that is associated with a range of bias voltages;

in response to the current induced in the photodiode, adjusting a bias voltage within the range of bias voltages across the avalanche photodiode to regulate the current induced by the avalanche photodiode such that the avalanche photodiode operates in the avalanche region.

9. The method of claim 8 further comprising monitoring the current induced in the avalanche photodiode using a current mirror.

10. The method of claim 8 further comprising monitoring the current induced in the avalanche photodiode by measuring a voltage across a sensing resistor in series with the avalanche photodiode.

11. The method of claim 8 further comprising monitoring the current induced in the avalanche photodiode by measuring a current through a current transformer.

12. A method of manufacturing an avalanche photo diode for use in fiber-optic communications the method comprising:

forming a field control layer between an absorption layer and a gain layer, the field control layer having a doping thickness product selected to determine a width of a dynamic range such that the gain of the avalanche photodiode is controllable by adjusting a bias voltage across the avalanche photodiode to cause the avalanche photodiode to operate along the dynamic range.

13. The method of claim 12, further comprising configuring the doping thickness product such that a lower portion of the dynamic range corresponds to a desired gain when highest expected power optical signals are received and an upper portion of the dynamic range corresponds to a desired gain when lowest expected power optical signals are received by the avalanche photodiode.

14. The method of claim 12, wherein forming a field control layer comprises forming the field control layer as an n^- doped InP layer.

15. The method of claim 12, further comprises forming the absorption layer as a InGaAs layer

16. The method of claim 12, further comprising forming at least one quaternary speed up layer between the field control layer and the absorption layer to prevent holes from piling up between the absorption layer and the field control layer.

17. The method of claim 12, further comprising forming a p⁺ doped InP layer on the gain layer.

18. The method of claim 12, further comprising lowering a doping thickness product to lower a punch-through voltage and raise a breakdown voltage to increase the dynamic range.

19. The method of claim 12, further comprising increasing a doping thickness product to raise a punch-through voltage and lower a breakdown voltage to increase a peak sensitivity.

20. The method of claim 12, further comprising lowering a doping thickness product to adjust an electric field in the absorption layer and decrease an electric field in the gain layer.

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